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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/891,238	06/27/2001	David Nister	040000-755	1534

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EXAMINER	
ROSARIO-VASQUEZ, DENNIS	
ART UNIT	**PAPER NUMBER**
2621	6

DATE MAILED: 05/06/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	09/891,238	NISTER, DAVID
	Examiner	Art Unit
	Dennis Rosario-Vasquez	2621

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 27 June 2001.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-20 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) 3-8 and 13-18 is/are allowed.

6)☒ Claim(s) 1,9,10,11,19 and 20 is/are rejected.

7)☒ Claim(s) 2,12 is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 27 June 2001 is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kanade et al. (US Patent 6,084,979 A) in view of Kim et al. (US Patent 6,314,211 B1).

Regarding claim 1, Kanade et al. discloses a method (fig. 4) for computing a fused depth map (fig. 4, num. 30) of a view of an object (fig. 4, num. 2), comprising:

a) obtaining camera calibration data for a new view of an object (Using figure 1, Kanade et al. states," The information captured by the scene transcription hardware 3 is used by an internal representation generator 4 to create an internal representation (col. 5, lines 17-20)."). Note that an internal representation is a camera angle of the scene at col. 2, lines 60-63, and that internal representations are derived from scene descriptions or camera calibration data. Note that scene descriptions are camera angles with corresponding pixels that represent depth at col. 4, lines 62-64.;

b) rendering each of a plurality of known depth maps of the object into the new view of the object based on the camera calibration of the new view (Using figure 2, Kanade et al. states," The method of the present invention may be carried a step further in which the internal representation 4 is implemented by creating object centered models 13 from the depth information. When object centered models are created, in effect CAD models of the objects are created. Thus, a view of the object from any viewing angle can be generated using standard CAD techniques (col. 5, lines 53-59) ."; and

c) computing the depth map elements(or scene descriptions) of a fused depth map (Fig. 4, num. 30:"Image Fusion") of the new view of the object, wherein each said depth map element corresponds to a pixel in the new view of the object (The scene description contains pixel and camera angle information for creating a new view) and wherein each said depth map element comprises of a set of rendered depth map elements, corresponding to the pixel, each from one of the plurality of rendered depth maps (Five slightly different depth maps are extracted at fig. 4, num. 26) (Using figure 4, Kanade et al. states," The purpose of the step of image fusion 30 is to integrate all the scene descriptions into one object-centered 3D model of the scene...(col. 8, lines 40-42)." Note that scene descriptions are camera angles with corresponding pixels that represent depth at col. 4, lines 62-64).

Kanade et al. does not teach the use of a median value for the fusion step, but does teach the use of a robust fusion algorithm that corrects depth errors during the combination of the scene descriptions at col. 8, lines 43-46.

However, Kim et al., in the field of endeavor of three-dimensional imaging, does teach the use of a median value to generate a composite or fused image. Kim et al. states, "...the median disparity is extracted among the aligned blocks and the disparities of all blocks [or sets]...are replaced by the median disparity...At this time, the disparity map is also modified (col. 16, lines 51-44)." Note that Kim teaches that a disparity between two images provides a value of depth at col. 1, lines 59-64. Thus the disparity maps in Kim et al. corresponds to the depth map of Kanade et al.

It would have been obvious at the time the invention was made to one of ordinary skill in the art to modify Kanade et al.'s robust fusion algorithm that corrects depth errors with the teaching of Kim et al.'s median disparity extraction, because the use of Kim et al.'s median disparity extraction improves "the quality of the new image... When the motion is measured and the new image is generated according to the above-mentioned block matching method, blocks may be shown in the generated new image or the quality may be deteriorated in the edge area. In order to compensate for this, a predetermined post-process, for example, filtering using a median filter is performed (Kim et al., col. 12, lines 38-48)."

Claim 11 is similar to claim 1, except for the following:

Regarding claim 11, Kanade et al. teaches a system (fig. 4) for computing a fused depth map (fig. 4, num. 30) of a view (fig. 4, num. 2) of an object (fig. 3), comprising:

a measurement device (fig. 4, num. 3 corresponds with fig. 1, num. 3).

a merging device (fig. 4, num. 30).

a processor (fig. 4, num. 28).

The remaining functions performed by these devices in of claim 11 have been respectively addressed in claim 1.

3. Claims 9,10,19 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kanade et al. (US Patent 6,084,979 A) in view of Kim et al. (US Patent 6,314,211 B1) and further in view of Martens et al. (US Patent 6,252,974 B1).

Claim 19 is similar to claim 1, except for the following:

Regarding claim 19, Kanade et al. and Kim et al. teaches a system (Kanade et al., fig. 4) for constructing a graphical representation of an object (fig. 15), as perceived from a desired view (Kanade et al. states,"...a view of the object from any viewing angle can be generated using standard CAD techniques (col. 5, lines 57-59."), from a plurality of calibrated views (fig. 4, numerals 2), comprising:

a measurement device (fig. 4, num. 3 corresponds with fig. 1, num. 3) obtaining camera calibration data (This element was addressed in claim 1a).

a first processor (Kanade et al., fig. 4, numeral 26 is part of a computer or processor of figure 4, numerals 26,28,30,32 and 33 and also depicted in fig. 1, num. 4 (col. 5, lines 20,21 and col. 10, lines 29-31) that extracts depth information stored in fig. 4, num. 3 and also depicted in figure 1, num. 3.Thus, Kanade et al.'s computer of figure 1, num. 4 is a processor which is also depicted within figure 4, numerals 26,30,32, and 33.) computing a plurality of depth maps (Figure 4, num. 26 uses a MBS technique that extracts dense depth maps of the images as shown in figure 5a-5e at col. 7, lines 1-5 and 14,15), each depth map (fig. 5a-5e at col. 8, lines 14-19 or "another image" as described below.) respectively corresponding (Kanade et al. finds a correspondence between a calibrated reference image and another image at col. 7, line 63,64 and col. 8, lines 17-19) to each of a plurality of calibrated views of the object (Kanade et al. uses a calibration object for each camera before the MBS technique at col. 7, lines 47-49; on the other hand, uses the MBS technique for generating a depth map from a reference image or calibration object from either 5a-5e at col. 8, lines 14-19.);

a merging device (Kanade et al., fig. 4, num. 28 merges data from numerals 30,32 and 33.) rendering a selected, computed depth map into the desired view for each of the plurality of computed depth maps (Kanade et al. states, "To render an object, event, or environment from viewing angles other than those where cameras are actually located from scene descriptions, a graphic workstation 28 (FIG. 4) may be provided to perform the function of the view generator 5 of FIG. 1 (col. 11, line 63 thru col. 12, line 1)." Note that scene description created in fig. 4, num. 3 are inputted to fig.

4, num. 26 which creates depth maps from figures 5a-5e using the MBS stereo matching technique.; and.

a third processor (The first processor as described above is the same as the third processor which comprises a part fig. 4, num. 30 that computes a fused depth map.) computing a fused (fig. 4, num. 30) depth map value (Fig. 4, num. 26 creates depth maps using the MBS stereo matching technique that is inputted into fig. 4, num. 30.) at each pixel (The MBS technique recovers dense depth maps, i.e., a depth estimate corresponding to every pixel at col. 7, lines 14-16) in the desired view (The desired view is created using the workstation 28 of fig. 4).

The combination of Kanade et al. and Kim et al. does not teach occlusion as required in for claim 19, but Kanade et al. does suggest a method for occlusion at col. 13, lines 6-22.

However, Martens et al., in the field of endeavor of depth measurements, teach occlusion of four views (fig. 2, num. 205 and 225) wherein as many rendered depth maps occlude said pixel as pass it by (Fig. 2, third column, third row shows a case of equal visible "1" and non-visible "-1" views due to occlusion.

It would have been obvious at the time the invention was made to one of ordinary skill in the art to modify the teachings of Kanade et al.'s occlusion and fusion with Martens et al.'s teaching of occlusion, because Martens et al.'s method of occlusion "is the simplest way of estimating depth over several frames…(Martens et al., col. 6, lines 51,52.)

Regarding claim 20, the combination of Kanade et al. teaches the system according to claim 19, further including an image projection device (fig. 4, num. 6:"MONITOR") projecting the graphical representation of the object as perceived from the desired view (addressed in claim 1), utilizing the computed fused depth map values.

Kanade et al. from the Kanade combination does not teach a median depth value.

However, Kim et al. from the Kanade combination does teach the use of a median disparity map or depth map to generate an image at col. 12, lines 38-48.

It would have been obvious at the time the invention was made to one of ordinary skill in the art to modify the depth maps of Kanade et al. with the median teaching of Kim et al. for the same reasons as claim 1.

The limitations of claim 9 have been addressed in claim 19 above, and thoses of claim 10 have been addressed in claim 20 above.

Allowable Subject Matter

4. Claims 3-8,13-18 allowed.

Claims 2 and 12 objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter:

The combination of the prior art does not suggest finding a depth area using occlusion of pixels with a support matrix for determining the depth area in combination with all the other features in claims 2,3,7,13, and 17.

Conclusion

5. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Minamida et al. (US Patent 6,633,664 B1) is pertinent as teaching a method of using camera calibration data to create a three-dimensional structure at fig. 2.

Jasinschi et al. (US Patent 6,504,569 B1) is pertinent as teaching a method of obtaining a median of an depth map based on camera parameters at col. 10, lines 61-64.

Snyder (US Patent 6,266,064 B1) is pertinent as teaching a method of selecting pixel based on occlusion (fig. 5).

Tirumalai et al. (IEEE) is pertinent as teaching a method of using a median with fusion of disparity maps at page 467, left column.

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dennis Rosario-Vasquez whose telephone number is 703-305-5431. The examiner can normally be reached on 9-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Leo Boudreau can be reached on 703-305-4706. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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